INNOVATION THROUGH COLLABORATION
Introduction

The Niche Vehicle Network promotes and stimulates R&D collaboration by bringing together independent vehicle manufacturers, system suppliers, research organisations, design and engineering companies, to collaborate on the application of innovative technologies in specialist vehicle production. Since 2005, the Network has provided funding and support to enable these companies to develop new technology and build prototype vehicles which form the basis of new products, demonstrating that the UK leads the way in the adoption of lightweight materials and advanced powertrain solutions.

In addition to providing funding for R&D projects, the Network offers its members a forum for knowledge sharing and formulating new business relationships, leading to collaboration and partnership working across the UK niche vehicle industry. The Network actively promotes and disseminates the outcomes of our projects at industry events, as well as hosting our own networking events throughout the year. In bringing the niche vehicle community together we can also ensure that our efforts are directed towards initiatives that add value to their businesses and help them to maximise their competitiveness.

The UK niche vehicle manufacturing sector plays a leading role in the early adoption of lightweight materials, hybrid and electric powertrains and other important low carbon technologies. By promoting collaboration between the niche vehicle manufacturers and the other organisations active in our sector the Network is playing a significant role in the regeneration of the UK automotive industry as we move towards cleaner, more efficient vehicle technologies.
Showcasing of Innovation

The Network provides members with the opportunity to showcase their capabilities to the industry at a variety of industry events, notably Cenex-LCV and Advanced Engineering, as well as at OEM showcasing events. These events provide members with the opportunity to meet potential customers and collaborators, as well as engaging with the wider industry.

Some quotes from recent events

“The JCB showcase of capability was a really great event with exposure to the right people. We had the chance to meet with some senior members of staff and some very influential people.”
- Penso

“I came away with some serious leads, from new and existing clients. The Advanced Engineering Show offered a good chance to broaden my knowledge too. The show seemed to be very well attended with a large number of visitors approaching the stand until the close.”
- Printed Motor Works Ltd

“Interest generated at Autosport International was encouraging in terms of sales with good publicity and exposure. The show was also an excellent networking opportunity.”
- Bowler Manufacturing Ltd

“At Goodwood Festival Of Speed we managed to gain around 20 strong leads and also sold a car directly after the event.”
- Caterham
Member Networking

The Niche Vehicle Network hold a number of events throughout the year which focus on providing networking opportunities to members. The Niche Vehicle Symposium and Member Forum events provide members with the environment and opportunity to engage with other members.

Some quotes from recent events

“As ever, the Members Forum had a very good spread of presenters, useful, informative with potential for a two-way follow up.”
- CAVT Ltd

“The Symposium was excellent, well organised, entertaining and informative.”
- Arkwright Scholarships Trust

“The Silverstone UTC was a fantastic venue with great networking opportunities.”
- 2 Spec Design

“It was very interesting to see the growth of the Niche Vehicle Network at the Symposium. The new contacts will be invaluable to our progress.”
- Riversimple
The aim of the project was to demonstrate the capability of controlled sub-ambient charge air cooling to improve fuel economy, reduce emissions and increase the power of highly boosted gasoline engines.

The project delivered a demonstrator vehicle fitted with the Active Charge Air Cooling system consisting of a turbo-expander at its core, control system and data-logging equipment.

The turbo-expander was designed and three units were manufactured as prototypes for production. The results show improvements in vehicle fuel economy, emissions and power outputs.
The primary objective of the LEFSE project was to further develop a structured baffle material for use in a novel Vortex exhaust system prototype, which would improve exhaust gas-flow by replacing chambered mufflers, while providing weight-saving, fuel efficiency and improved combustion.

Upon project completion, we had developed a Vortex exhaust system that achieved; negligible back pressure, reduced noise, a weight-saving of 22%, anticipated fuel efficiency better than 10%, reduced diesel particulate emissions, plus the emissions saving from reduced fuel consumption.
This project aims to reduce the weight, cost, NVH and environmental impact of carbon fibre body structures by replacing a proportion of the carbon layers with natural flax fibre, which is low cost, low density, sustainable and has excellent vibration damping properties.

The partners have designed, developed and manufactured a set of rear panels and closures for the Riversimple Rasa hydrogen car using novel carbon/flax micro-sandwich technology. The panels are lightweight, have class A finish and good NVH response.
SERV is a small efficient recreational vehicle prototype, demonstrating a Rage Buggy chassis powered by the novel Pulse-R Multi-gas engine driving through a novel hydraulically actuated, intelligent CVT transmission.

The SERV project has delivered a fully functional prototype recreational vehicle. The OakTec 400cc Pulse-R gas engine is calibrated for high torque, exceptional fuel efficiency and low NOx emissions over a working range between 1500 and 3600 RPM. Performance and efficiency is optimised by driving the lightweight Rage chassis through the GOTec intelligent CVT that is calibrated to match the driving demands and efficiency sweet spots of the Pulse-R engine.
This project aimed to demonstrate two complementary innovations in Battery Management System (BMS) design, intended to reduce unit costs, simplify long term maintenance and enhance safety.

A working proof of concept was developed which dispenses with active balancing circuitry and eliminates the wiring harness by using powerline technology. The novel BMS technology provides improved battery condition monitoring while enhancing robustness and reliability leading to potential cost and weight savings. The developed technology is applicable to high voltage battery systems within automotive, marine and other lithium battery applications.
Prototype modular-hybrid electric drivetrain designed for the niche vehicle sector following a Saietta 2016 NVN feasibility study supported by Westfield investigations. Prototype aimed to facilitate the widespread adoption of 48V and low emission hybrid systems by OEMs. The system to be retrofittable with no changes to existing ICE.

A structural composite energy storage monocoque mountable under the floor of the Westfield demonstrator vehicle supporting two seats. The modular electric drivetrain installable on the front axle of a Westfield Sport Turbo.
Westfield Technology Group leads a world class consortium to develop a hybrid super capacitor system for autonomous vehicles. Westfield are working with Hyperdrive Innovation and Zap&Go to enable a range extension/fast charge mechanism for the vehicles to optimise performance and increase utilisation for a fleet of PODs.

Outputs of the Project
Improve the performance of the battery system by decreasing the weight of batteries by 30%
Enable the vehicle to continually run for 5 hours
Inshore the manufacturing of the 48V battery system and graphene supercapacitor
Increase the utilisation of the vehicle from 67% to 80%
Decrease average fleet emissions for Westfield by 30% by 2020
The aim of our project was to develop a low cost, cloud based, drive cycle simulation tool for hybrid and electric niche vehicle suppliers and manufacturers, providing access to a platform that allows easy evaluation at a vehicle level the effect of different powertrain options.

We have been implementing mathematical models which allow the user to pick off the shelf components from cells to motors and build a virtual vehicle that can be tested across standard and custom drive cycles.
The AERO-P collaborative research and development project sets out to investigate aerodynamic performance and efficiency for low volume high performance ICE, electric and hybrid electric vehicles. Key aims of the project are to minimise aerodynamic drag and to develop passive and active aero devices for vehicle safety, stability, control and braking.
The BLiSS project has delivered the Caterham 7 spaceframe at 10% less weight whilst meeting key benchmark performance and cost targets. Achieved by the application of Reynolds double butted tube technology within a Simpact virtual engineering programme, the project delivers the world’s first automotive steel spaceframe utilising this innovative concept.
MHS+2 removes mechanically linked engine ancillaries including the alternator, air compressor and hydraulic power steering and replaces with specially designed electrically driven alternatives that are intelligently controlled. These eAncillaries consume less power and therefore contribute to reducing fuel consumption and emissions on transit buses. A power dense lithium ion battery provides the energy storage.
Using structural composites for low volume car manufacture is limited due to the high manufacturing costs. Whilst composites are more widely used in vehicles like the BMW i3, sufficient volumes are needed to cover the high tooling costs. This project challenges the current position to enable an affordable solution for a niche vehicle composite chassis.
The AffCAR project bridges the gap between the short-cycle process of press-formed CFRP using expensive metal tooling and the much slower autoclave manufacturing on lower-cost tools, by combining flexible and rigid tooling in a press process. Efficient fastener integration is an additional target to reduce unnecessary bonding.
MagHot has developed a manufacturing route, enabling a step change in the manufacture of ultra-lightweight magnesium pressings. MagHot has extended the HFQ® process for hot forming of Magnesium, to overcome existing forming and economic limitations. The project has successfully delivered an ultra-lightweight Morgan cowl panel with a 35% mass saving.
The ultra-lightweight sports car project took an innovative approach to extreme engine downsizing through the research and development of a lightweight vehicle structure and powertrain. By coupling an Axontex™ carbon-fibre passenger cell with steel subframes and the use of a lightweight rotary-engine, the project has achieved significant weight savings beyond conventional solutions.
Aeristech and MAHLE Powertrain have demonstrated an electrically driven supercharger (eSupercharger) as a technology enabler for extreme downsizing.

Aeristech’s eSupercharger, intergrated to MAHLE’s 1.2 L downsized engine in tandem with a large conventional turbocharger, successfully achieved a specific power output of 161kW/L, whilst improving the low speed torque and transient response of the engine.
The results of this project have led to the development of innovative approaches for mounting and mechanical integration of fuel cells in lightweight electric vehicles, including exploring the feasibility of a demountable fuel cell.

Partners are Arcola Energy, Riversimple, Microcab and Coventry University.
The LEAP project investigated the creation of a low cost lightweight distributed electrical system to replace a conventional vehicle wiring harness.

Target: to reduce system weight while increasing functionality.
The resulting LEAP system has been functionally tested and validated, delivering an 85% weight saving compared to a conventional Atom harness.
Micro Hybrid System Plus (MHS+) is a system to reduce the emissions and improve fuel economy on heavy duty diesel engines.

The project brings together three unique technologies; electrified engine cooling from AVID Technology, electric supercharger from Controlled Power Technologies and high density energy storage from Goodwolfe Energy and was tested at Newcastle University’s engine dyno facility.
The Hybrid Atom Stop Start Concept integrated an electric motor into the Ariel Atom drivetrain, with added stop start functionality.

In rolling road and track testing, the system produced an increase of 20Nm and 23hp over the standard performance of the engine, on demand, and recharged the custom ultra-capacitor module using regenerative braking.
The aim of this project was to create an ultra-lightweight exhaust by using thin-guage material, reducing part count and exploring the boundaries of high grade stainless steel and manufacturing processes, while maintaining Aston Martin exhaust system deliverables.

Overall, the system weight reduced by 45% from 27.8kg to 15.1kg, a saving normally associated with titanium.
O&H vehicle conversions in partnership with J&A Kay and Panel Systems have developed a workable solution for a lightweight Accident and Emergency Ambulance. Using the latest in vacuum forming and composite technology developed within this project, we are sure the solution will develop into the lightest, most fuel efficient, most ergonomic, and most hygenically clean A&E Ambulance on the market.
The EV3+ Battery project explores the latest battery technology.

Results have exceeded expectations with a pack design capable of delivering 2.4 times the capacity for the same weight and a smaller volume than a current production specification pack whilst maintaining manufacturability, serviceability and reusability for end of life.
The project aim was to both apply existing technology in a new area, by the application of ceramic brakes on an electric vehicle, whilst also developing new technology, a novel surface coating technology, to further enhance weight saving, improve performance and reduce cost of existing carbon ceramic brake technology.
The Lightweight Composite Door Structures project developed and demonstrated innovative vehicle weight reduction through the application of carefully selected composite materials.

In addition, the low mass solution addressed the themes of vehicle safety and recyclability by assessing the ability to meet the requirements of side impact protection.
Compound Rotary Engine for Electric Vehicles (CREEV)

This project aimed to validate the concept of using an exhaust expander unit to improve the efficiency and emissions of a rotary engine.

The results have shown that a potential 30% power gain and 20% emissions reduction are possible without adding excessive weight or size to the overall engine unit.
This project’s objective was to demonstrate and validate the concept of integrating an electric supercharger to an existing range extender engine to increase power output without altering the engine architecture. The completed integrated range extender engine now exhibits an increased power density, from 30 kW to circa 50 kW output.
The goal of this project was to create a new control platform that increased the life and efficiency of power systems in fuel cell hybrid applications. The consortium designed and built an innovative electrochemistry model based Electronic Control Unit, which optimised the performance of fuel cell systems while increasing design flexibility.
The primary objective of this project was to investigate and create a viable, safe and desirable electrically driven single seat quadricycle.

The proposed vehicle represents a safe and efficient mode of transport without the drawbacks associated with two wheeled mopeds or the poor efficiency and emissions of current quadricycle products.
This project set out to investigate and prove the production viability of using laser ablated bonded titanium sheet as a material for low volume and small series automotive structure applications.

The project successfully developed an innovative manufacturing methodology which reduced rear subframe mass by 36% and improved manufacturing efficiency.
The objective of this project was to design, manufacture, install and test a novel and complex exhaust after-treatment system for the reduction of methane emissions from dual-fuel diesel/natural gas engines for heavy duty vehicles.

The project delivered a prototype system, which demonstrated, verified and validated its catalytic and mechanical operation.
This project aimed to produce a world leading electric vehicle demonstrator showcasing 4WD and torque vectoring capability and utilising the latest motor and battery management technology.

Three significant project developments were implemented on an existing Delta E-4 Coupe, giving enhanced efficiency and functionality as well as a wider stability envelope.
The PREMO project simulated and prototyped a high efficiency engine concept that applies a novel gas dynamic and combustion system to 4-stroke engine architecture.

The prototype immediately bettered power and emissions performance of market leading small engines and showed exceptional fuel efficiency of 234g/kwhr, despite having scope for considerable further optimisation.
The project aimed to develop a carbon-ceramic brake system for lightweight niche vehicles; reducing unsprung weight and improving handling and performance for both road and track applications. Working in collaboration the partners successfully designed a new brake disc 60% lighter than the original steel disc, saving 2.5kg per unsprung corner.
The objective of the project was to investigate the sound attenuation properties of a new unique sintered metal baffle material developed by Fibre Technology Ltd. On project completion we proved that silencers made using Fibretech sintered metal can be made smaller with superior sound attenuation properties than alternative materials.
The purpose of this project was the research, design and production of lightweight prototype components and systems aimed at accelerating the introduction of a new eco-friendly Westfield sports car. The average weight saving achieved across the parts was 23% (target 20%) with further savings to be realised on other vehicle parts.
Funded Research & Development

The Niche Vehicle Network invests in R&D projects focused on the niche and specialist vehicle manufacturing sector.

Sponsored by the Office for Low Emission Vehicles (OLEV), Innovate UK and the Advanced Propulsion Centre (APC), our competitions are focused on providing SMEs active in the low carbon vehicle technology sector with funding to undertake collaborative research and development activities through the following competitions:

1. The Niche Vehicle Feasibility Competition provides grants for industry-led projects focusing on catalysing innovative low carbon vehicle technologies through the undertaking of initial desk-top research activities. Eligible projects under this competition are not required to be collaborative.

2. The Proof of Concept Competition provides grants for UK niche vehicle manufacturers and associated design and engineering companies to undertake the research and development of early market low carbon technology demonstration projects, primarily applicable to non-human powered road and off-highway low volume vehicles.

3. The Production Readiness Competition provides grants for UK SMEs and their supply chain to take existing low carbon vehicle technologies from demonstration through to production readiness in a compressed timescale.

In addition to the above competitions, the Network provides selected OEM members with access to aerodynamic benchmarking sessions at the MIRA Full Scale Wind Tunnel. Each round of Niche Vehicle aerodynamic benchmarking sessions provide a total of 2 hours of aerodynamic support with a senior MIRA aerodynamicist present to examine and interpret the results that are being seen within the tests and associated data. The consultant will be there to help guide the participants as to where any issues may lie with the aerodynamics of the vehicle.

For further information on our current and future competitions visit www.nichevehiclenetwork.co.uk